CALIFORNIA DIVISION OF MINES AND GEOLOGY

Fault Evaluation Report FER-73

March 1, 1978

1. Name of faults: Mission Hills, Devonshire, and related faults.

2. Location of faults: Oat Mountain and San Fernando 7.5 minute quadrangles, Los Angeles County (see figure 1).

3. Reason for evaluation: Part of a 10-year program; requested by City of Los Angeles.

4. List of references:

a) Barnhart, J.T., and Slosson, J.E., 1973, The Northridge Hills and associated faults -- a zone of high seismic probability? in Geology, seismicity, and Environmental Impact: Association of Engineering Geologists, Special Publication, p. 253-256.

b) Barrows, A.G., Kahle, J.E., Saul, R.B., and Weber, F.H., Jr., ~~1974~~, 1975 ? Geologic map of the San Fernando Earthquake area in San Fernando, California, earthquake of 9 February 1971: California Division of Mines and Geology, Bulletin 196, map scale 1:18,000.

c) Bishop, William C., 1950, Geology of the southern flank of Santa Susana Mountains, county line to Limekiln Canyon, Los Angeles County, California: Unpublished M.A. thesis, University of California, Los Angeles. x

d) Hazzard, J.C., 1944, Some features of the Santa Susana thrust, vicinity of Aliso Canyon field, Los Angeles County, California (abs): Bulletin of the American Association of Petroleum Geologists, v. 28, p. 1780-1781.

e) Jennings, C.W., 1975, Fault Map of California with locations of volcanoes, thermal springs and thermal wells: California Division of Mines and Geology, California Geologic Data Map Series, Map no. 1, scale 1:750,000.

f) Pacific Soils Engineering, Inc., May 6, 1977, Limited seismic investigation, tract no. 21930, Rancho El Mission de San Fernando, City of Los Angeles, California: Unpublished consulting report, 12 p., 4 plates.

g) Pacific Soils Engineering, Inc., December 1, 1977, Limited geologic and seismic investigation, tract no. 30749 (formerly tentative tract no. 21930), Rancho El Mission de San Fernando, City of Los Angeles, California: Unpublished consulting report, 12 p., 4 plates (Note: this report is essentially the same as the May 6, 1977 report).

h) Slosson and Associates, 1977, Geologic/seismic investigation, proposed north of Rinaldi Street school site, Mayerling St., Granada Hills, California: Unpublished consulting report, 22 p. 5 appendices, 7 figures.

i) Wentworth, C.M., and Yerkes, R.F., 1971, Geologic setting and activity of faults in the San Fernando area, California in The San Fernando, California earthquake of February 9, 1971: U.S. Geological Survey Professional Paper 733, p. 6-16.

j) Ziony, J.I., Wentworth, C.M., Buchanan-Banks, J.M., and Wagner, H.C., 1974, Preliminary map showing recency of faulting in coastal southern California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-585, 15 p., map scale 1:250,000, 3 plates.

5. Summary of available data:

The Mission Hills, Devonshire and related faults are shown by Jennings (1975) as cutting Quaternary units. Ziony, et al. (1974) show many of the same faults as late Quaternary (see figure 2).

Two basic references were consulted: Bishop (1950) and Barrows, et al. (1974). Bishop mapped the western end of the Devonshire and Hadley faults as concealed (figure 3). However, it appears that he used the concealed symbols in areas concealed by vegetation or soil and not only in areas where younger deposits concealed the faults and contacts. This conclusion must be drawn since Bishop (p. 73-74) describes both faults as post-older terrace deposits and depicts the faults cutting these deposits in the cross-sections. Both the Hadley and Devonshire faults are south-dipping reverse faults that connect at depth. For this reason some investigators consider the Hadley to be a branch of the Devonshire (Barnhardt and Slosson, 1973, p. 255). Bishop calculated that the total displacement along the Devonshire was 2500 to 4500 feet, and along the Hadley was 300 to 400 feet.

Barrows, et al. (1974) show both the Devonshire and Hadley faults as post-Saugus (Plio-Pleistocene) but pre-terrace or older fan deposits (see figure 4). In fact, they show a myriad of faults cutting Saugus Formation but none cutting younger units.

(Note: There are three significant drafting errors on the map (#1 and #3 on figure 4) showing faulted younger units. Saul (p.c., 2/23/78) has confirmed that these are drafting errors. Faults (#2 on figure 4) are also shown cutting Pico Fm.; here the outcrops of Pico were too small to delineate on the map.

Two recently completed consulting reports by Pacific Soils Engineering, Inc. (1977a and b) call for setbacks from an east-trending fault in Bull Canyon (site A on figure 4) implying that an active fault was found. Barrows, et al. (1974) recognized faulted Pico Formation in the canyon, but the alluvium was not cut (Saul, p.c., 2/24/78). Pacific Soil Engineering ~~found~~ inferred the fault to be present based on ~~using~~ seismic refraction. They determined that the fault only came within ten to fifteen feet of the surface, and stated no topographic expression was present that could have been created by recent faulting. This inferred fault was not verified by trenching or other direct observation.

Slosson and Associates (1977) reportedly found bedrock thrust over soil along the Mission Hills fault (site B on figure 4). Saul (p.c., 2/23/78) confirmed that this was indeed the relationship he observed in the trenches on the Slosson and Associates site. Saul also confirmed Smith's observations (see item 7) that there was no apparent fault-produced topographic feature on the site.

Slosson and Associates (1977, p. 12) concluded that at least three segments of the Mission Hills fault..."that show some evidence of Holocene activity..." cross the site. This Holocene age was based solely on the soil-bedrock relationships (p. 21). They reported numerous faults (e.g. trench one had 11 faults in a zone about 150 feet wide) present; indeed they state (p. 14) that the entire canyon may be underlain by faults based on borehole data. However, their trench logs only show bedrock thrust over soil in one place (C on figure 5). In one place the soil forms a "V" into the fault (D on figure 6; and the third fault "displacing" soil is not clearly noted. It may be either at E or F on figure 5, however, no fault symbols are present at either location.

(I inferred that the wavy lines are faults; there is no legend for the trench logs in the report). In any case, 1) there is no apparent topographic expression in the surface profile of the logs; 2) the investigators did not differentiate between soil horizons or different ages of soil; and, 3) the soils were not dated using any method (e.g., C^{14}). We have only the consultants' word that these soils are Holocene. They did not discuss whether the soils could have formed due to differential weathering after any fault movement occurred.

6. Interpretation of air photos: Not attempted.

7. Field observations:

In January 1978 I examined the site investigated by Slosson and Associates (1977; see item 5). The soil, in general, appeared to be fairly thin, residual soils. It is doubtful that any datable material could be found in the soil. There was no topographic feature on the site that would indicate recent faulting had occurred.

Conclusions:

The Devonshire and Hadley faults may be late Pleistocene in age (Bishop, 1950); however, there is no evidence for Holocene displacement. Indeed, Barrows, et al. (1974) suggest that these faults do not cut late Pleistocene deposits. The discrepency could be due to two different ages (both late Pleistocene) of the two units, or one source could be wrong.

The Mission Hills fault is a poorly defined zone of diffuse faulting. Probable ~~L~~late Pleistocene faulting has been documented at the Slosson and Associates (1977) site, and while Holocene faulting has been suggested by the consultant it has not been conclusively demonstrated. Perhaps even more importantly the possibly-active fault strands are not well-defined. Therefore, it is almost impossible to establish a zone along the fault.

9. Recommendations:

Based on the present project guidelines and the data summarized herein, neither the Devonshire, Hadley, or any faults other than the Mission Hills fault are considered sufficiently active~~; therefore,~~ to warrant zoning. ~~of those faults is not recommended~~.

The Mission-Hills fault may be active; however, this "fault" is actually a diffuse, poorly defined zone of faulting. Until additional data concerning the location of the fault can be developed -- if it can be developed -- zoning is not recommended.

10. Investigating geologist's name; date:

Theodore C. Smith

THEODORE C. SMITH
Assistant Geologist
RG 3445
March 1, 1978

I concur with the recommendations.
EWH
4/21/78

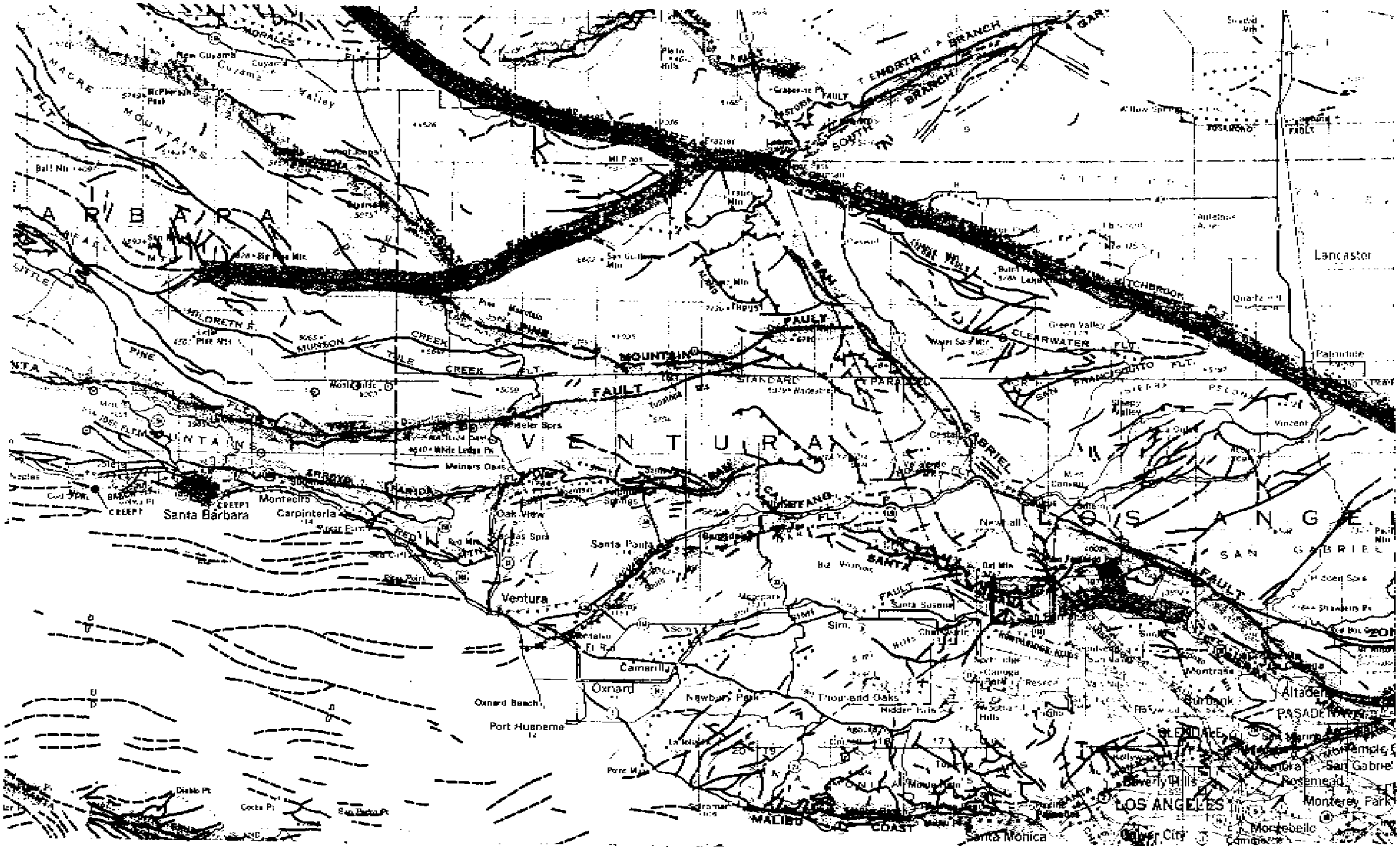

Figure 1, Location of Mission Hills, Devonshire, and related faults discussed in FER-73.

LOS ANGELES SHEET

FER 73

Figure 2. Fault-classification map showing the Mission Hills (1), Devonshire (2), and related faults. L indicates late Quaternary; P indicates late Pliocene &/or Quaternary (after Ziony, et al, 1974)

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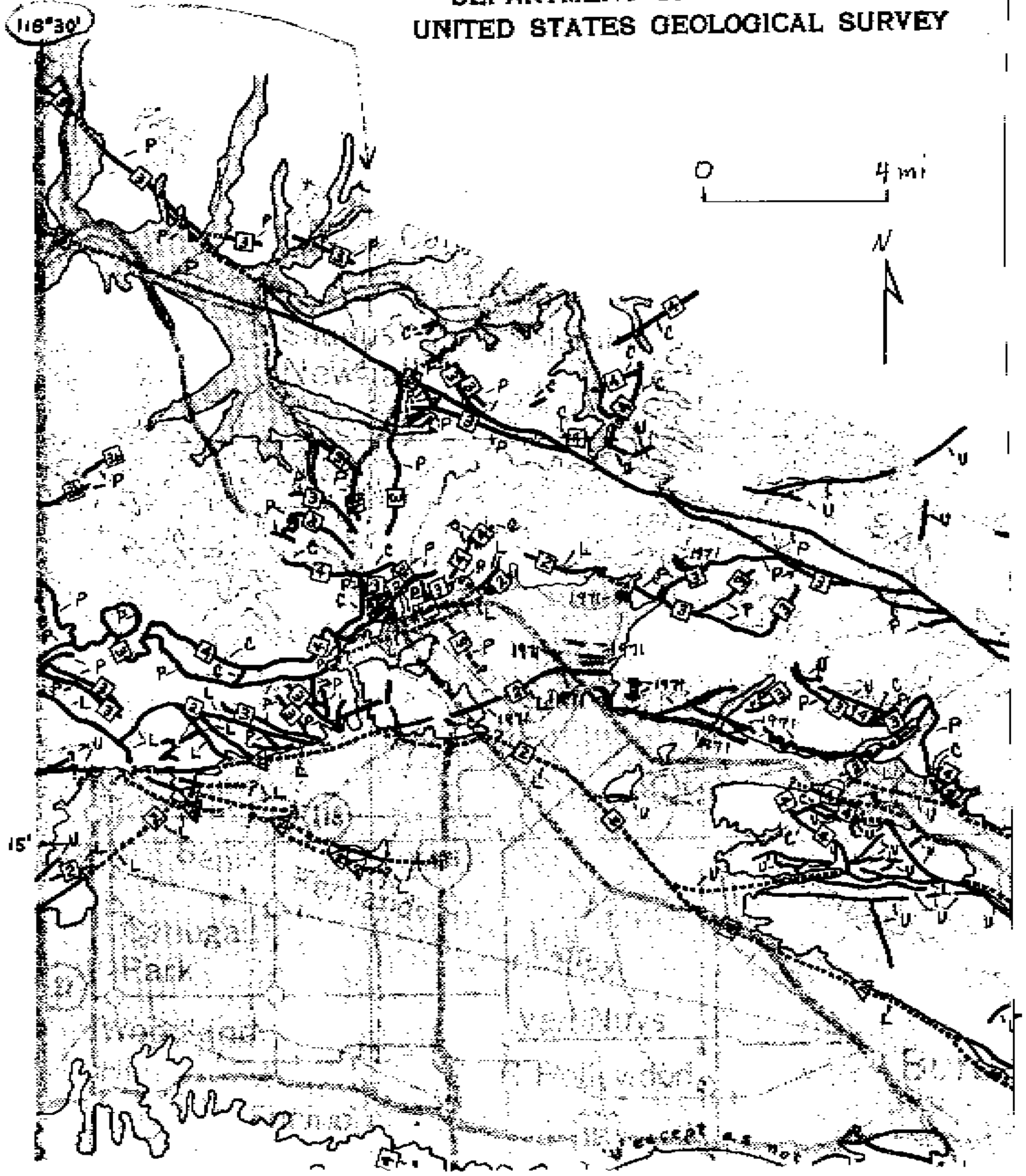
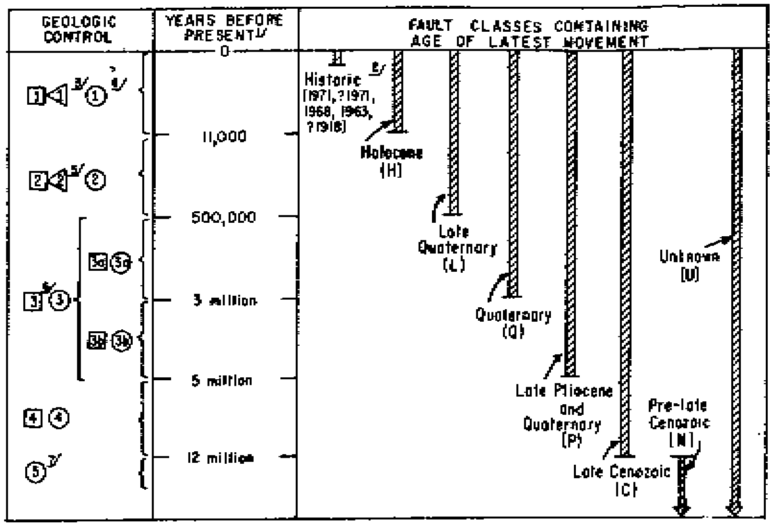


AGE RANGE CHART OF GEOLOGIC CONTROLS AND AGE CLASSES



1/ Years are approximate and are based in part on radiometric dates from strata in southern California. Column is not to scale

2/ Queried where nature of ground rupture is questionable. 1968 and 1963 events presumed to be man-induced faulting associated with oil field operations (see text)

3/ Geomorphic criteria for Holocene faulting: sag depression; offset stream course in Holocene deposits; linear scarp in Holocene deposits; or, linear submarine scarp in seafloor sediments above wave base

4/ Control from overlapping Holocene strata not shown on map except where such deposits are known to be at least 3,000 years old

5/ Geomorphic criteria for late Quaternary faulting: offset stream course in Pleistocene or older deposits; linear scarp in Pleistocene deposits; markedly linear steep mountain front associated with adjacent concealed fault trace; or, linear submarine scarp in seafloor sediments below wave base

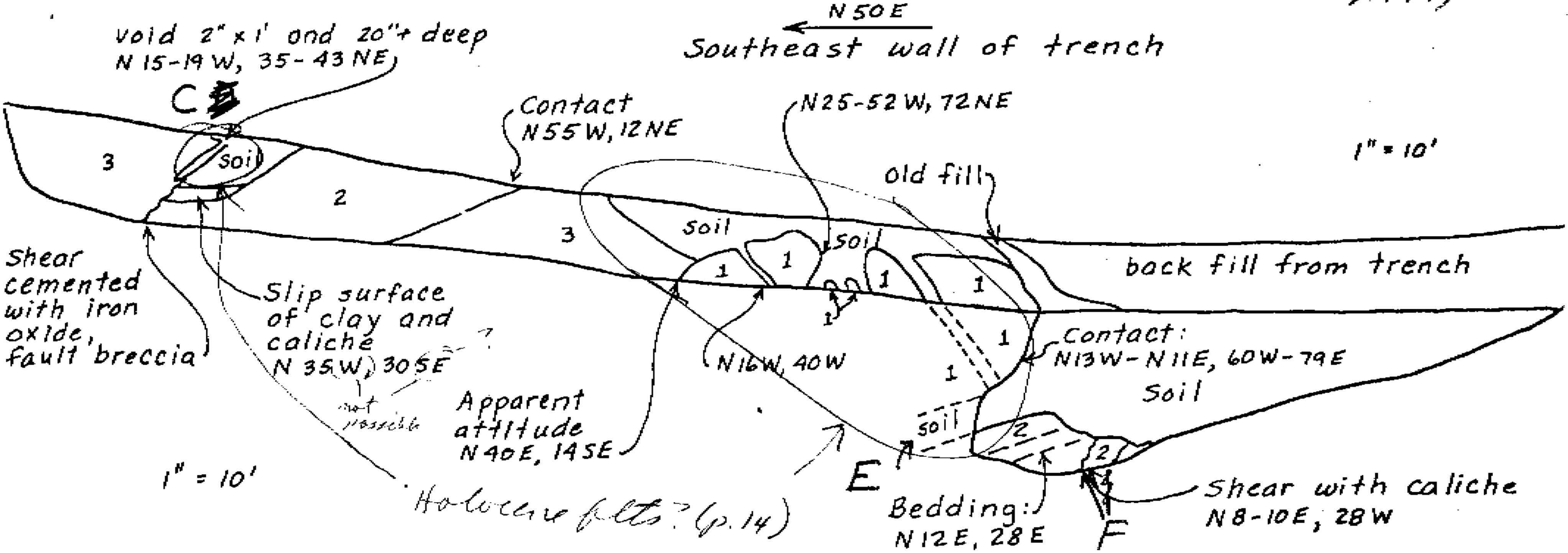
6/ Numeral 3 designates nonmarine strata of late Pliocene to early Pleistocene age. Numerals 3a and 3b designate marine strata of early Pleistocene and of late Pliocene age, respectively

7/ Pre-late Cenozoic minimum geologic control consists of intrusive rocks about 12 to 20 million years old

IMINARY MAP SHOWING

IN COASTAL SOUTHE

Figure 5, FER-73. Trench log across branch of Mission Hills(?) Fault (Slosson, 1977)



Soil: pebbly silty sand, medium grayish brown, blocks of coquina

Bedrock:

1. coquina: fragments of shells 1/4"- 2" and sand, white, locally fractured with soil filling

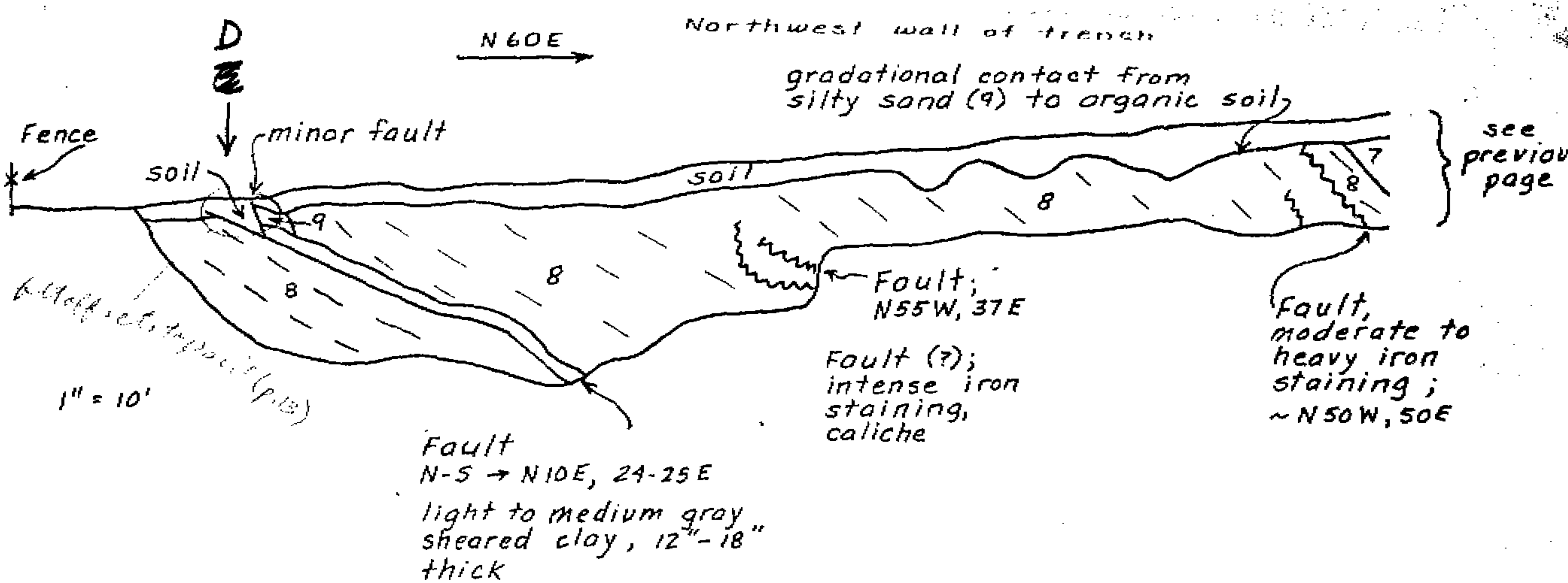
2. sand, pebbly to silty, greenish gray to reddish brown, locally bedded

3. sand, fine to coarse grained, medium reddish brown to light gray

8-4-77

TRENCH 2A
NORTH OF RINALDI SCHOOL SITE

Figure 6, FER-73. Trench log across branch of Mission Hills Fault (Slosson, 1977).



Bedrock (continued)

4. sand, fine to medium grained, contains about 30% shell fragments, very light to light gray, massive bedding, well consolidated.
5. sand, very fine to fine grained, very light gray, massive bedding, well consolidated
6. sand, very fine to fine grained, tan to light brownish gray, mottled
7. sand, light yellowish gray with mottled iron staining, numerous caliche shears, no visible offset
8. sand, fine grained, tan to rusty gray, mottled, interbeds of coarse grained sand and silty sand.
9. sand, fine grained, light gray

7-25-77

TRENCH I (continued)
NORTH OF RINALDI SCHOOL SITE